



STRATEGIES FOR PROMOTING META-LEARNING AMONG SECONDARY SCHOOL STUDENTS

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ABSTRACT

Meta-learning or learning to learn, is described as the state of being aware of and taking control of one's learning. It involves the awareness and understanding of the learning itself as opposed to understanding the given subject. It has gained significant recognition as a fundamental skill for students in today's challenging and rapidly evolving educational landscape. Meta-learning is prevalent and deep-rooted in cognitive psychology and is a much-needed skill to be developed among children of all ages and stages. This review aims to underscore the meaning of meta-learning, its steps, and the importance of cultivating meta-learning abilities in students and give insights to educators, parents, policymakers, and researchers with a comprehensive understanding of the current state of knowledge in promoting meta-learning in school students. This paper discusses the implications for classroom practices, strategies, interventions, and approaches to encourage meta-learning and highlights the scope for future research.

KEYWORDS: Meta-Learning, Metacognition, Academic Achievement, Metacognitive Teaching Strategies.

INTRODUCTION

Formal education can be defined as a process of learning skills and knowledge within a structured school system. The main aim of schooling is to develop understanding and acquire knowledge about different concepts and subjects. Teachers play a vital role in students' learning, as the facilitators who help the students to construct their understanding (NCF, 2005).

In the current educational scenario, teachers are to prepare 21st-century students in their classrooms, tackle various challenges both in academics and real-life situations, and help them become independent lifelong learners (NEP, 2020). To achieve this, students must be taught how to think, rather than what to think. Students who are aware of their own thinking can monitor and regulate their thoughts and behaviours. Thinking about one's thinking is called metacognition. Metacognition enhances student's ability to master 21st Century skills such as critical thinking and problem-solving skills. They should be trained in metacognitive thinking in learning so that they can be aware of their learning process and this is meta-learning.

Meta-learning is a facet of metacognition that focuses on understanding one's learning process. The term "meta" denotes going beyond or above, thus, meta-learning involves grasping the concept of learning itself or acquiring the skill of learning. Metacognition is defined as the process of reflecting on one's thinking, which plays a crucial role in developing self-awareness as such meta-learning holds significant value as an aspect of education. It revolves around empowering students to take charge of their learning journey, emphasizing self-regulation and the cultivation of knowledge and awareness regarding their cognitive processes. This notion of applying metacognition to students' learning independently has been discussed by scholars such as Flavell (1976), Biggs (1985), and

Novak & Gowin (1984).

Concept of Meta-Learning

The idea of meta-learning was coined in 1979 by Maudsley. He described it as the learning process in which a learner becomes aware of his or her innate abilities of learning through perception, inquiry. Later it was explained by Biggs (1985) as a state of being aware of and taking control over one's learning process.

As mentioned by Biggs & Telfer (1987), when a student recognizes themselves as an active participant in the learning process, meta-learning occurs. This awareness enables students to choose learning strategies that align with their goals and motivations. They move beyond simply focusing on what to learn to fulfil educational objectives. Once these strategies become ingrained in their repertoire, students can adapt and apply them to various problem-solving scenarios throughout their lives, fostering lifelong independence in learning. Meta-learning involves envisioning and planning for the future and developing strategies to attain desired outcomes. It represents a higher level of learning, reshaping perceptions of the learning process, and encompasses a personal understanding of learning that involves cognitive, emotional, and physical aspects, integrating the mind, body, emotions, and feelings.

Meta-learners actively participate in self-regulation by planning, monitoring, and assessing their learning journey. This cultivation fosters metacognitive awareness among learners, leading to comprehension of the processes involved as well as the attitudes guiding their learning endeavours. It encompasses self-awareness regarding one's learning preferences, specifically recognizing the learning strategies and behaviours suitable for a given learning environment (Jackson

2004; Boström and Lassen 2006).

Going further, Zang (2008) characterizes meta-learning as the mental conditioning of individuals to become cognizant of their own learning methodologies, study tactics, and approaches to learning. This concept is also influenced by the context and situation, fostering a sense of identity and active involvement in the learning process. It involves regulating one's behavior to enhance learning outcomes or deepen understanding, as well as the capacity to step back and perceive the broader scope of learning. This enables individuals to adapt and modify their learning approaches in response to changing conditions and emerging knowledge.

It also includes learners' attitudes, such as their conviction in their ability to effectively manage their own learning and their confidence in using the skills and knowledge they have acquired (Jackson, 2004). From this perspective, meta-learning can be seen as an active, internal process wherein learners' reflect on themselves and their environment to evolve and to regulate (Boström and Lassen 2006; Winters 2011). Research indicates that effective meta-learning participation can improve academic achievement (Biggs 1985). Students can become more skilled learners when they become aware of the effectiveness of the many tactics they use when their metacognitive awareness of learning processes is supported (Jackson 2004). Additionally, it can be a powerful tool for encouraging students to reflect on their own learning (Biggs 1985; Winters 2011). Meta-learning aligns with students' self-awareness of their learning processes, reflections, actions students employ to achieve their academic goals and also has a close relationship with self-regulation (Zimmerman 2000, 2002; Winne 2010). Thus, meta-learning is about understanding the process of learning itself, beyond just acquiring subject-specific knowledge.

Learners who are involved in meta-learning activities often reflect on their learning goals and purpose. They also choose and adapt appropriate strategies and monitor their learning or performances. Increased meta-learning activities level suggests a high metacognitive abilities or a deep approach to learning. It has been observed/ advised that younger learners can be more easily introduced to meta-learning than to metacognition, in order to assist them in conscious planning, execution, and assessment of their learning strategies. In this process students will learn how to learn, how to apply their learning, and to convey their acquired knowledge and skills. In order to become effective learners, students need to identify and describe the problem, collect information, choose among various alternative solutions and decide how to assess the selected solutions and reflect upon them for further actions.

Steps Involved in Meta-Learning Process

Meta-learning can be generally defined as an awareness of one's employment of learning strategies which involves the following steps (Chan, 1987);

- knowledge of ability
- monitoring of ability-related task
- control of learning task
- reflections on the purpose of learning.

- evaluation of learning

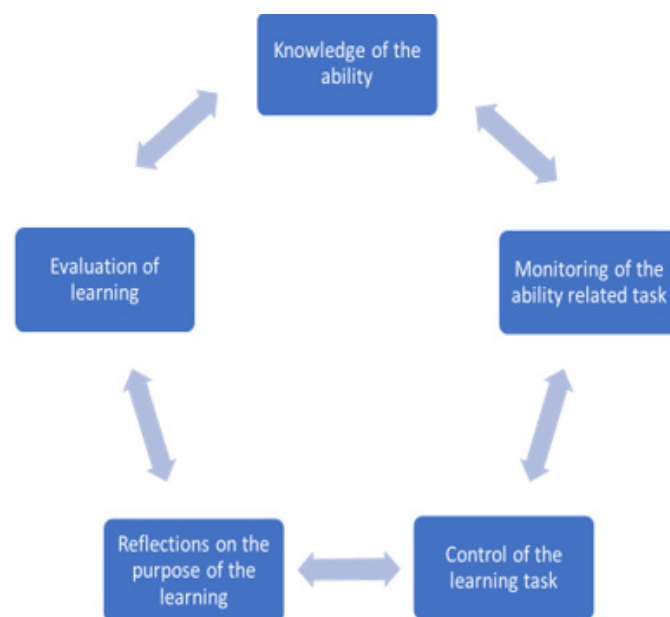


Fig 1. Steps of Meta-Learning

Stages of Meta-Learning	Strategies used in the classroom by teachers to develop	Assessment of meta-learning
Knowledge of ability	Teachers employ metacognitive teaching strategies such as explicit teaching and the k-w-l-h chart (Ogle, 1986) to make students aware of what ability they are going to learn.	An ability-related test is employed to test the knowledge about the abilities acquired by the students
Monitoring of ability-related task	Teachers through questioning and thinking aloud strategies can enable students to set goals for their learning, select suitable abilities for the task, and monitor the ability-related task.	Teachers observe and record students' performance and interview them, and self-report questions to assess monitoring of ability-related tasks.
Control of learning task	Through metacognitive teaching strategies, students develop the skills to control the learning task by checking on the progress in achieving their goals and setting the pace of their learning.	Self-reporting questions and reflections of students can be used to assess their control of learning task

Reflections on the purposes of learning	Students reflect on goals and the effectiveness of their achievement. They reflect on their learning strengths and weaknesses.	A reflective field dairy can be maintained to record the reflections of students on the purpose of their learning
Evaluation of learning	K-w-l-h chart can be used to evaluate the abilities' effectiveness. Reflections can be used to assess the strength of the learning and modifications or corrections can be made in the learning strategies to achieve the goals.	Self-reporting questions and reflections are used to assess the student's ability to evaluate their learning.

Table 1: An illustration to demonstrate the steps followed in the meta-learning process

In other words, meta-learning entails being conscious of what one already knows about the specific task at hand, comprehending the requirements of the task, and managing and controlling the task-completion process. Three types of knowledge are needed to solve problems: Situational or Conditional knowledge (when & why), Procedural knowledge (how), and Declarative knowledge (what). The following are the regulatory processes involved in finishing the task:

- Choosing appropriate strategies.
- Plan and arrange the task or solution in an orderly manner.
- Keep an eye on the current activity.
- Evaluating the task's progress and making adjustments as needed.

The capacity to apply knowledge, abilities, and solutions to related situations is the most crucial aspect of meta-learning (trans-situational). It is self-directed, with each learner developing their own skills through self-awareness. This ability of students assuming a greater responsibility for their education and developing into independent, self-reliant, and self-regulated learners are the main components of meta-learning.

Why is meta-learning important?

Meta-learning is important as it can profoundly impact students' academic achievement through various cognitive, metacognitive, and motivational mechanisms. It supports and enhances performance by fostering a greater understanding of the background and subject matter of the educational process. According to Ogwo and Oranu (2006), this awareness includes the learner's intentional comprehension of the learning task and sequence as well as their attention, thinking patterns, attitudes, learning techniques, motivations, past knowledge, memory, comprehension, and beliefs. The student is free to choose the learning techniques that best fit her or his objectives. Once these techniques are ingrained in their knowledge base, they can modify and utilize them for any work or problem-solving scenario that arises outside of the classroom.

Research demonstrates that promoting meta-learning techniques effectively improves academic performance across different fields of study. For instance, these techniques have been shown to enhance the academic achievement of technical college students in building trades (Eze, Ezenwafor, Molokwu 2015), as well as improve academic achievement and retention among college students (Eze, Obidile, & Akamobi 2019). Additionally, teachers' implementation of meta-learning strategies in science subjects has been found to significantly enhance students' academic performance (Dike, Mumuni, & Chinda 2017).

In contrast to topic knowledge, meta-learning is the awareness and comprehension of the phenomena of learning itself. Understanding the expectations of a learning activity is part of the learner's view of the learning content. A learner with a high degree of awareness of meta-learning is able to evaluate the efficiency of her/his learning strategy, whereas a learner with a low degree of awareness of meta-learning is not able to think critically about her/his learning strategy (Norton & Walters, 2005).

Engaging in meta-learning approaches while studying a subject allows students to challenge their understanding and perceptions, facilitating a deeper comprehension and engagement with the material at higher conceptual levels (Winters, 2011). Therefore, meta-learning is a powerful tool for promoting academic success by empowering students to take control of their learning processes and achieve higher levels of understanding and performance.

Thus, meta-learning needs to be developed in students at all levels of their learning to assist them in learning new knowledge and skills, practicing new knowledge and skills, developing the ability to independently apply the new knowledge and skills, and empowering them to become self-regulated lifelong learners. Meta-learning can be developed in students through instruction employing meta-teaching strategies.

Strategies for promoting meta-learning in classrooms

To enhance students' self-directed learning and academic achievements, as well as to support teachers' professional growth, it's essential to integrate meta-learning techniques into classroom instruction (Pui-wah, 2008). Teachers can effectively employ these techniques that include, discussing the objectives before starting the class, outlining the thinking process skills involved in a lesson to make students conscious of the learning task. They can use different attention capturing techniques and specify several evaluation tasks and questions for each stage of instruction for this purpose. (Eze, Ezenwafor & Molokwu, 2015).

Along with these techniques, other metacognitive strategies can be used to develop meta-learning in students. According to Novak (1987), metacognitive teaching strategies empower learners to assume control of their learning in a meaningful manner. These strategies, utilised by both teachers and students, serve as skills to attain desired objectives, allowing learners to regulate their cognitive processes effectively.

Numerous metacognitive teaching strategies can be implemented in classroom settings to cultivate meta-learning skills. Various researchers have identified a range of techniques for enhancing metacognitive learning. For example, Ashman and Conway (1997) described a number of strategies for enhancing metacognitive skills, such as explicit explanation, cognitive coaching, scaffolded instruction, and cooperative learning. Rivers (2001) divided metacognitive techniques into self-management and self-assessment groups. Gamma (2004) outlined seven metacognitive tactics, including the use of graphic organisers like K-w-l-h charts and mind maps, reflective questioning and prompting, metacognitive scaffolding, modelling, self-questioning, think-aloud and self-explanations, and self-assessment.

Meta-learning	Steps	Metacognitive Strategies can be employed
	Knowledge of generalisation ability, critical thinking ability, and problem-solving ability	Explicit teaching and Reciprocal teaching can be used to develop knowledge of abilities
	Monitoring of ability-related task	K-W-L-H chart, Reflective Questioning, and Thinking aloud can be
	Control of learning task	Thinking aloud and Questioning
	Reflections on the purposes of learning	K-W-L-H chart, Thinking aloud, Reflective questions/ journal
	Evaluation of learning	K-W-L-H chart, self-assessment, Graphic organisers

Table 2: Mapping of Meta-Learning Steps with Metacognitive Teaching Strategies

Deliberate utilisation of these strategies by teachers during classroom interactions can effectively foster the development of meta-learning competency among students. Research conducted by Karpicke, Butler, & Roediger (2009) indicated that students who engage in self-testing or retrieval practices during studying demonstrate significant improvements in their ability to select, monitor, and regulate their learning strategies. By employing metacognitive teaching strategies, teachers can influence the development of meta-learning skills in students. Assessment of meta-learning can be conducted through various means such as reflective questionnaires, evaluation of learning competencies, and observation of learners' attitudes and interactions (Hoskins & Fredriksson, 2008).

This can be understood by a sample of lesson design which illustrates the steps of meta-learning in a science classroom by employing metacognitive teaching strategies.

Teaching context	Metacognitive Teaching Strategies (MTS) used	Steps of Meta-learning
Topic: Functions of Cell membrane; Osmosis and diffusion		
In the engaging stage, students recall the cell and its components and write what they know about cell membrane functions (K), and what they want to know (W) in the K-W-L-H chart.	K-W-L-H chart, Questioning	
During the development of the concepts like osmosis and diffusion which are the functions of the cell membrane, the teacher presents examples of the concept and students are made to identify the similarities and differences to identify the common characteristics and arrive at the generalisation. The teacher presents more examples of the concepts of osmosis and diffusion and makes them compare and distinguish between the examples of these concepts. During the process of conceptualization, students' think- aloud when identifying the characteristics of a concept and the teacher tests their understanding through questioning. Teachers develop an understanding of students' generalization ability during their learning process. Students write in the KWLH chart about what they have learned (L) and how they learned (H) the concepts by reflecting upon the process of their learning.	Questioning, Think-aloud, K-W-L-H chart	Knowledge of generalization ability
Students set goals for their learning as functions of the cell membrane and work towards achieving them. They perform tasks during their learning process like analyzing the different examples and identifying the characteristics of the concepts.	Think-aloud, Questioning	Monitoring of the ability-related task
They check their progress in task completion and seek help from a teacher or peer when they need to do the task.	Think-aloud, Questioning	Control of task
Through questioning, teachers encourage students to reflect on what they are learning and why they are learning.	Questioning, Think-aloud	Reflections on the purpose of the learning

Students self-evaluate their learning and write how they learned and how well they know about the concepts of osmosis and diffusion by completing the KWLH chart.	K-W-L-H chart, Questioning	Evaluation of learning
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Table 3: Sample science lesson of Grade 9 illustrating the meta-learning steps by employing metacognitive teaching strategies

CONCLUSION

In conclusion, it can be emphasised that meta-learning represents a pivotal aspect of education, offering students the tools and strategies to become autonomous, self-regulated learners. Educators can effectively nurture students' meta-learning competencies through the deliberate integration of metacognitive approaches in classroom instruction, leading to enhanced academic success and self-directed learning. Researchers have identified many metacognitive teaching strategies, ranging from direct explanation to self-assessment and reflective questioning. Studies have shown that students engaging in metacognitive practices, such as self-testing and retrieval, experience notable improvements in their ability to select, monitor, and regulate their learning strategies. Furthermore, the measurement of meta-learning can be facilitated through self-reporting questionnaires, assessment of learning competencies, and observation of learners' attitudes and interactions. By embracing meta-learning principles and techniques, educators can empower students to navigate the complexities of the learning process effectively, equipping them with the skills needed for lifelong learning and academic success.

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